July 29, 1941. D. A. WEBER ET AL 2,250,737

APPARATUS FOR SCREENING MATERIALS

Filed May 15, 1939 2 Sheets-Sheet 1

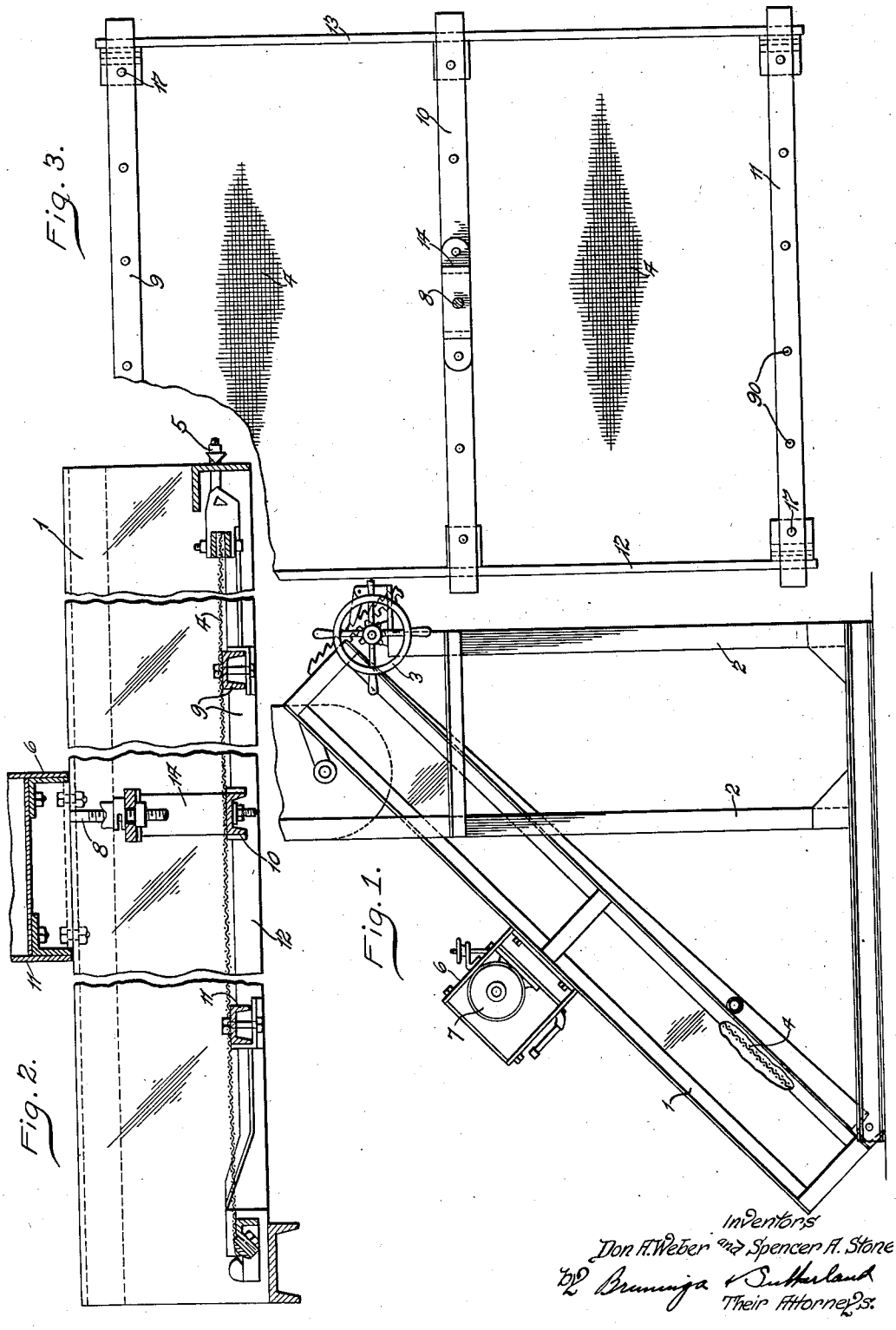

Fig. 3.

Fig. 1.

Fig. 2.

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Fig. 4.

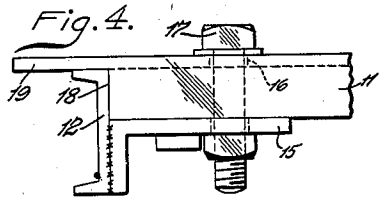


Fig. 7.

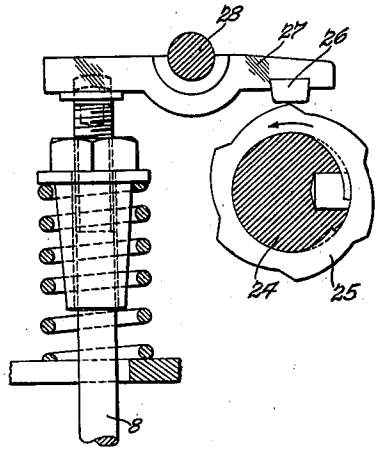


Fig. 5.

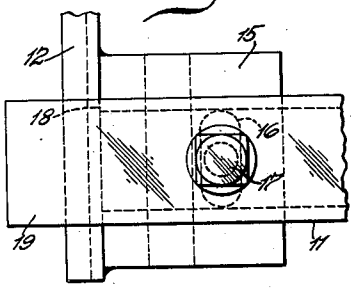


Fig. 6.

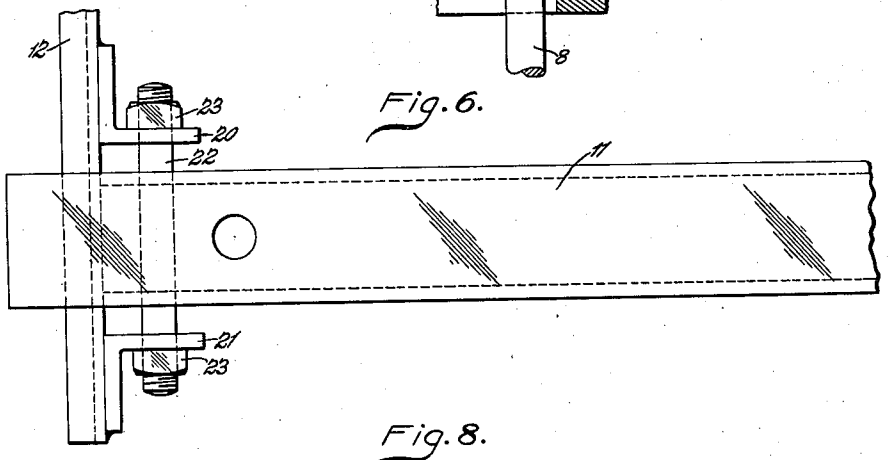
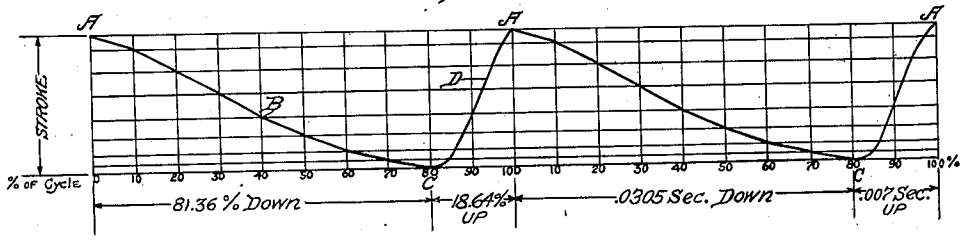


Fig. 8.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR SCREENING MATERIALS

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Application May 15, 1939, Serial No. 273,713

2 Claims. (Cl. 209—310)

This invention pertains to a screening apparatus of the type in which a screen cloth or fabric is vibrated in a direction normal to the plane of its surface, while the material is caused to travel over the surface of the screen fabric.

One of the objects of this invention is to provide an improved process for screening materials with the aid of this type of apparatus.

Another object is to provide improved screening apparatus which will increase the output thereof.

Another object is to provide screening apparatus in which an extended area of the screen fabric is set into vibration at a substantially uniform amplitude so as to increase the screening efficiency thereof.

Another object is to provide improved means for mounting the screening medium for adjustment of the tension thereof to a correct initial value and arranged to accommodate subsequent readjustment to take up slack accruing during operation without binding or otherwise interfering with the action of said medium in vibration.

Further objects will appear from the following description taken in connection with the accompanying drawings in which Figure 1 is a view in elevation showing generally the type of apparatus to which this invention is applied. Figure 2 is a longitudinal sectional view of the screen frame. Figure 3 is a plan view of the vibrating panel. Figure 4 is an enlarged detail of the vibrating panel. Figure 5 is a plan view of Figure 4. Figure 6 is an enlarged detail similar to Figure 5 showing a modified construction. Figure 7 is a detail section showing the vibrating mechanism, and Figure 8 is a diagram indicating the type of vibration produced by the mechanism of Figure 7.

In the ordinary screening apparatus of this type the vibrating mechanism is connected so as to transmit the vibratory motion to the screen fabric usually at a single location extending in a line across the middle of the screen cloth. With this arrangement the amplitude of vibration of the screen cloth at this point of application and in a line across the screen is a maximum, while at any other point of the screen the amplitude will be less than this, and will decrease progressively from this maximum point to the points where the screen is pivotally fastened at the ends of the screen cloth assembly. Accordingly, there is only a limited area near the point of application of the vibrating mechanism at which the screen operates with maximum vibratory action.

In accordance with this invention means are provided to vibrate an extended area of the screen fabric with this maximum amplitude. This causes the whole of this extended area to operate at maximum screening efficiency and, therefore, greatly increases the output of a given apparatus.

In the structure selected for illustration in the drawings, a screen frame 1 is supported usually in an inclined position on a suitable base or support 2. Suitable adjusting means 3 may be provided for adjusting the angle of inclination of the frame 1. A screen cloth or fabric 4 is stretched in the frame 1 and may be tensioned by suitable tensioning devices 5. Mounted on a suitable cross frame or bridge 6 is vibrating mechanism indicated generally at 7 from which a connection or stem 8 extends downwardly to be connected to the screen fabric 4 so as to vibrate the latter.

The stem 8 is connected to the screen fabric through a vibrating panel or sub-frame shown in plan view in Figure 3. This panel comprises a plurality of rigid bars or vibrating beams 9, 10 and 11. These are connected together near their ends by coupler bars 12 and 13. The middle vibrating bar 10 is connected by means of a yoke 14 to the vibrator stem 8. Each of the bars 9, 10 and 11 may be secured to the screen fabric, as by fasteners 90, at intervals along their length so as to cause the fabric to move with these bars. The end bars 9 and 11 are secured to the coupler bars 12 for adjustment lengthwise. This is in order that these bars may move along the coupler bars 12 and 13 as the screen fabric is tensioned to the desired extent.

In order to accomplish this purpose the structure shown in Figures 4 and 5 may be employed. In this arrangement an inwardly extending angle member 15 is secured to each coupler bar 12 and 13 at each end preferably by welding. This member 15 forms a clamping block to which the bar 9 or 11 may be clamped. The block 15 has formed therein an elongated slot 16 adapted to receive adjustably therein a clamping bolt 17 passing through a suitable perforation in the end of the bar 11. The bars 9, 10 and 11 may be formed with a channel section so as to render them stiff. Where they engage the coupler bars 12 however, the flanges may be cut back as shown at 18 leaving an extended portion of the upper web 19 of the channel to rest upon the bar 12 or 13. For the end bars 9 and 11, these extended webs 19 may slide upon the bars 12 and 13. With this arrangement the bolts 17 may be loosened and then the screen fabric tensioned so as to stretch

it to the desired extent. During such tensioning the bars 9 and 11 may move along the bars 12 and 13 so as to accommodate themselves to the stretch of the screen cloth. When the proper tension adjustment has been obtained the bolts 17 may be tightened to secure the bars 9 and 11 rigidly to the coupler bars 12 and 13 and to maintain the vibrating panel in adjustment conforming to the tension of the screen cloth.

In the arrangement of Figure 6, in place of the clamping blocks 15, the bars 12 and 13 may be provided with inwardly extending angle members 20 and 21 spaced apart so that the downwardly extending flanges of the bars 9 or 11 may be positioned therebetween, and their spacing is sufficient to permit movement of the bar 11 along the bars 12 and 13 to accommodate the tensioning of the screen cloth. The members 20 and 21, as well as the downwardly extending flanges of the bar 11, are drilled with aligned holes adapted to receive a guide bar 22 which may be secured in place by nuts 23 at its ends. This construction permits the bars 9 and 11 to slide along the bars 12 and 13 as the screen cloth is tensioned, and at the same time the bars 22 retain the bars 9 and 11 securely and rigidly assembled with the coupler bars 12 and 13 so as to form a rigid vibrating panel.

The vibrating mechanism illustrated in Figure 7 may be similar to that described in Patent No. Re. 16,701, issued to Richard A Leahy, and Patent No. 1,712,817, issued to Victor E. Flanagan. As illustrated in Figure 7, it comprises a shaft 24 carrying a cam 25 provided on its periphery with a series of teeth engaging a follower block 26 on a lever 27 pivoted on a pin 28. The stem 8 is connected in any suitable manner to be vibrated by the outer end of the lever 27.

The type of motion imparted by such a cam is illustrated in Figure 8, in which the stroke of the stem 8 is plotted vertically and time horizontally. The curve in this figure shows that the downward movement of the stem 8 is gradual as indicated by the portion B of the curve. At the bottom of its stroke a gradual change of direction is made, indicated by the rounded part of the curve C. From this point a rapid upward movement takes place, as indicated by the part D of the curve. It will readily be understood that this portion D of the curve corresponds with the downward movement of the block 26 along the short inclined face of the cam 25. At the bottom of this incline the block is suddenly arrested by engaging the succeeding cam surface with a hammer blow. This causes a sharp reversal of the movement of the screen at the point A in Figure 8. It will be noted that this reversal point is at the end of the upstroke of the screen fabric and the beginning of the succeeding down stroke. Accordingly, during this upstroke of the cycle of operation the screen cloth rises, projecting the particles of material upward with forces proportional to their masses. A stratification of the materials results, therefore, as the oversize particles seek the top of the material bed, while the undersized particles ride the screen jacket. When the movement of the screen cloth is suddenly arrested at the top of its stroke, the intermediate sized particles, which may become wedged in the meshes of the screen cloth, are dislodged so that a continuous "unblinding" action is maintained.

It will be noted that this action of the screen cloth takes place not only at a single line across the middle of the screen cloth with other points thereof not only falling off in amplitude, but effecting a progressive smoothing out of the curve of Figure 8, due to resiliency of the screen jacket as the stationary ends thereof are approached, but the full amplitude of vibration and the correct "wave form," as indicated in Figure 8, are maintained throughout the area of the screen between the bars 9 and 11. Accordingly, a sharp unblinding action and a highly efficient stratifying action are maintained throughout the area of the vibrating panel. As this area is several times the effective area of a screen having only a single vibrating bar, it will be clear that a very considerable improvement in efficiency is attained.

It will be noted, therefore, that in accordance with the process of this invention, the material to be screened is passed over the screen fabric while the latter is vibrated and the amplitude of such vibration is maintained substantially uniform throughout the extended area of the screen cloth covered by the vibrating panel shown in Figure 3. By this process the material, as it passes over the screen, is subjected throughout a major portion of its travel to a vibratory action on the intermediate area of the screen jacket in which not only is the full amplitude of vibration maintained, but the full characteristic of the curve of Figure 8 is maintained. In other words, throughout this portion of its travel the material is treated with a rapid upward movement, which is suddenly arrested so as to maintain a strong unblinding action, followed by a much more gradual downward movement, permitting the particles to settle on the screen, and a relatively gradual change from downward to upward movement so as to avoid wedging intermediate sized particles in the meshes of the screen.

While this invention has been described as embodied in a unitary apparatus, it will be understood that certain individual features or subcombinations thereof may be useful by themselves without reference to other features or the main combination, and that the employment of such individual features or subcombinations is contemplated by this invention as within the scope of the appended claims.

It is obvious furthermore that various changes may be made in the details of construction or procedure within the scope of the appended claims without departing from the spirit of this invention, and that accordingly the invention is not limited to the specific details shown or described.

Having thus described the invention what is claimed is:

1. A screening apparatus of the character described, comprising, a stationary support, an elongated screen fabric, means for mounting said fabric by its ends in said support in a downwardly sloping position and for vibrating movement perpendicular to its plane, said mounting means being constructed to apply endwise tension to said fabric, a framework having longitudinally and laterally extending members and secured to said fabric so as to frame a portion thereof extending laterally to points near its side edges and longitudinally to points intermediate its middle and its ends but substantially spaced from both, and vibrating mechanism connected to vibrate said frame with substantially equal amplitude throughout, whereby to establish on the vibrating fabric successive operating regions including an initial region at the upper end adapted to receive material as fed to the screen and in which

the amplitude of vibration increases progressively from its upper end downwardly, an intermediate region defined by said frame in which the amplitude of vibration is a maximum and substantially constant, and a final region at the lower end of said fabric in which the amplitude of vibration decreases progressively toward the bottom end thereof.

2. A screening apparatus of the character described, comprising, a stationary support, an elongated screen fabric, means for mounting said fabric by its ends in said support in a downwardly sloping position and for vibrating movement perpendicular to its plane, said mounting means being constructed to apply endwise tension to said fabric, a frame having longitudinally and laterally extending members and secured to said fabric, and means for connecting said members together in relatively shiftable relation so as to permit said members to accommodate themselves to the stretch of said fabric when the latter is tensioned.

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